DOCUMENT RESUME

ED 105 271 CE 003 579

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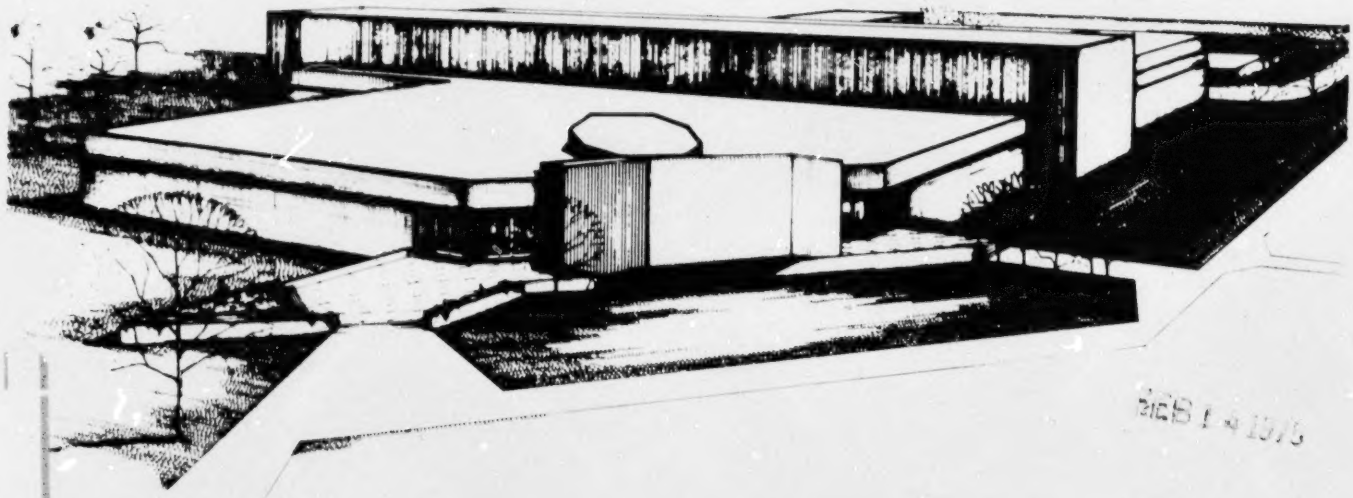
TITLE Innovations in Industrial Arts Teacher: Education--Curriculum--Facilities--Methodology.
PUB DATE Dec 74
NOTE 20p.; Speech presented to the Industrial Arts Division of the Annual Meeting of the American Vocational Association (New Orleans, Louisiana, December 1974)

EDRS PRICE MF-$0.76 HC-$1.58 PLUS POSTAGE
DESCRIPTORS Certification; Cluster Grouping; *Core Curriculum; *Curriculum Development; Education Majors; *Facilities; Facility Guidelines; Facility Planning; Industrial Arts; Industrial Arts Teachers; *Industrial Education; Instructional Innovation; Program Content; *School Shops; Teacher Education

ABSTRACT

The University of Northern Iowa Department of Industrial Technology is involved in a three-phase curriculum development project along with new facility design and construction and implementation of instructional innovations. The report reflects decisions made to date in the process, including the completed phase of developing concept-based cluster courses to serve all majors in the department, including education majors. Second and third phases will focus on advanced technical courses, the professional sequence, and the graduate program. Considered in the report are factors influencing industrial arts teacher education at all levels, such as components of the industrial arts education program, State certification requirements, university regulations, programs offered by the department, the faculty, basic core theory courses, and facilities design and flexibility. Many diagrams illustrate the report, particularly in the area concerning physical facilities. (MDW)



ED105271

INNOVATIONS IN INDUSTRIAL ARTS TEACHER EDUCATION

★ CURRICULUM

★ FACILITIES

★ METHODOLOGY

SPEECH PRESENTED AT

AMERICAN VOCATIONAL ASSOCIATION CONVENTION

(INDUSTRIAL ARTS DIVISION)

DECEMBER - 1974

BY

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INNOVATIONS IN INDUSTRIAL ARTS TEACHER EDUCATION

Curriculum - Facilities - Methodology

Alvin E. Rudisill

The Department of Industrial Technology at the University of Northern Iowa is presently involved in: (1) major revisions in curriculum structure; (2) new facility design and construction; and (3) implementation of innovations in methods of instruction. Our long range goal is to be able to provide individualized competency-based instruction in comprehensive conceptual areas of industrial technology and to focus instruction in advanced courses on technical specialization and small group activities related to solving technical problems. This presentation will provide a brief status report of our efforts along with supporting rationale for some of the subjective judgments that have been made in the decision making process.

The curriculum development aspects of our project have been probably the most difficult. We have just completed the first phase of curriculum development involving the development of conceptual based cluster courses which could serve all majors in the department including industrial arts teacher education. This phase will be implemented during the 1975-76 academic year. The second phase of our curriculum project will involve a review and up-dating of our advanced technical courses and our professional sequence. During the third phase we will concentrate on a complete review of the graduate programs offered in the department.

Generally, there are four components in any industrial arts teacher education degree program which must be considered in curriculum design. At the University of Northern Iowa, requirements in these components are forty semester hours in general education, fifty-five semester hours in the industrial arts education major, twenty-three semester hours in professional education, and twelve semester hours in electives which may be taken in any of the other component areas. (See Figure 1).

COMPONENTS OF TEACHER EDUCATION PROGRAM

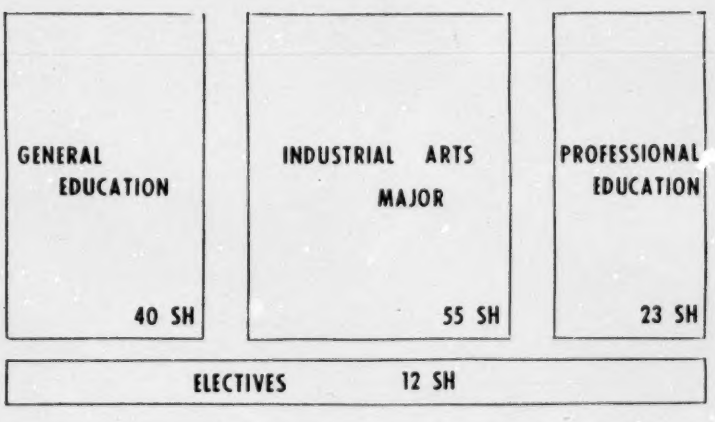


Figure 1

The Industrial Arts Education major which will be implemented next fall includes five elements: (1) applied mathematics-science; (2) basic core theory courses; (3) basic core laboratory courses; (4) advanced technical courses; and (5) professional courses in industrial arts. The technical elements of this major all focus on the three conceptual clusters of production, power, and communication. Content in the clusters is related primarily to material processing in the production cluster, energy processing in the power cluster and information and idea processing in the communications cluster. (See Figure 2). All core courses are required. The student, however, is able to elect advanced technical courses in one of the areas of construction, manufacturing, power or communications.

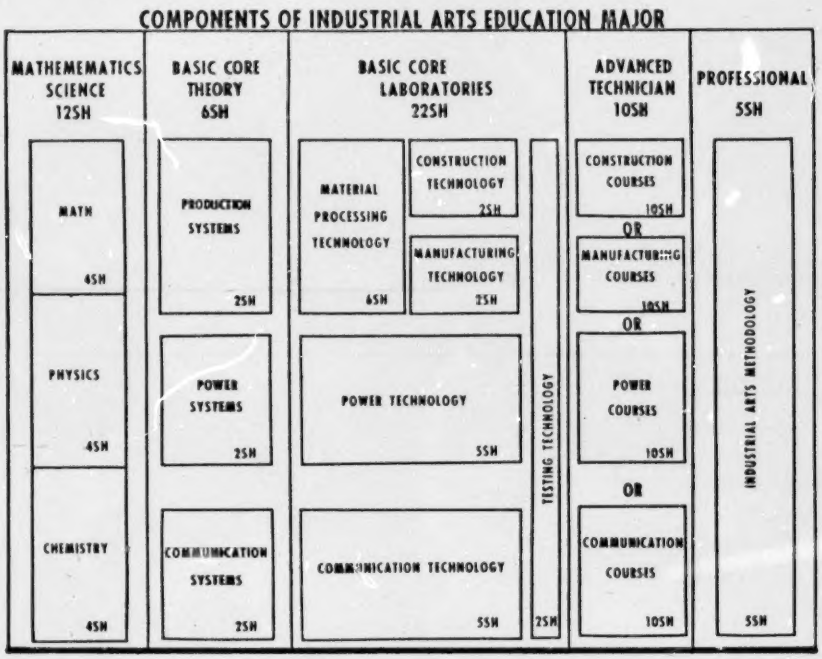
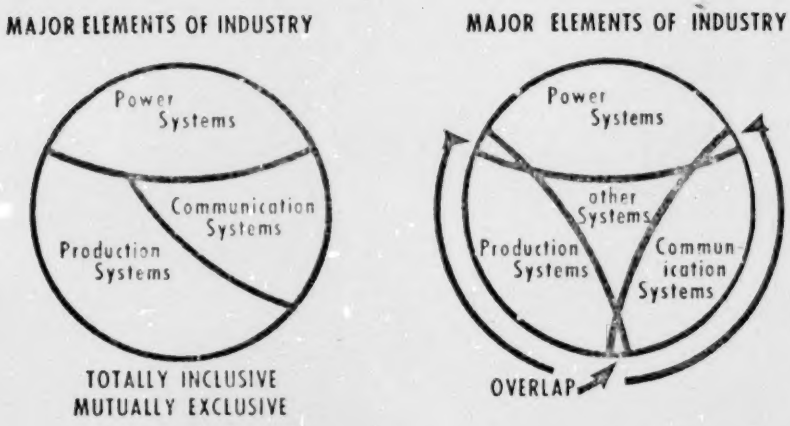


Figure 2

There are a number of factors which influence the content structure of the Industrial Arts Education major at the University of Northern Iowa and other teacher education institutions. These factors are being discussed to clarify some of the decisions made in the design of our curriculum structure.

The content classification model developed or adopted by a department will have major implications for content structure. "Ideal" classification systems will have content elements which are totally inclusive as well as mutually exclusive as shown in Figure 3. It must also be operationally adequate. Our departmental content model does not completely meet the first two requirements. A team effort, however, is being made by our faculty to avoid needless duplication of content in the various program components. The aim is to provide students with an insight into the uniqueness and interrelationships of the major elements identified.

FACTORS INFLUENCNG INDUSTRIAL ARTS TEACHER EDUCATION



CONTENT CLASSIFICATION MODEL

Figure 3

Another factor which has a significant influence on industrial arts teacher education programs is state certification requirements. In Iowa at the present time we have only one option in industrial arts and that is K-14 certification. (See Figure 4). This means that we must provide all students with a comprehensive background in all the content areas identified for the program as well as to allow some flexibility for specialization in a technical option. Our content structure probably would have contained more options if state certification was granted in K-6, 6-9 and 9-12 categories.

FACTORS INFLUENCING INDUSTRIAL ARTS TEACHER EDUCATION

STATE CERTIFICATION REQUIREMENTS

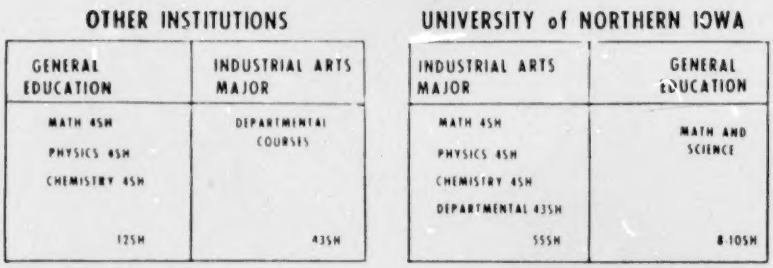
5

Figure 4

Unique university regulations also influence content structure and credit hour requirements. At the University of Northern Iowa there is a limit of fifty-five semester hours for majors and "credits for courses required for a major must be counted as a part of that major." Since our faculty believes that applied math, physics and chemistry are essential for all majors, then we must count the credit hours in these courses toward the major. As indicated in Figure 5, this leaves forty-three semester hours for course work offered within the Industrial Technology Department.

FACTORS INFLUENCING INDUSTRIAL ARTS TEACHER EDUCATION

"CREDITS FOR COURSES REQUIRED FOR A MAJOR MUST BE COUNTED AS A PART OF THE MAJOR"



UNIQUE UNIVERSITY REGULATIONS

Figure 5

The number of major program options offered in a department affects the instructional approach. As indicated in Figure 6, the Industrial Arts Education major is only one of five major programs offered in our department. Since all the technical core courses in the department and most of the advanced technical courses are taken by industry as well as education majors, they must be completely technical rather than enhanced by content related to teaching methodology.

The number of students majoring in a department and within certain program options in a department influences the number of advanced technical courses which can be offered by a department. Figure 7 shows the enrollment problems encountered in third level technical courses within the power cluster when only forty-five students are enrolled in the required basic core course. There are some techniques for coping with this problem such as offering courses alternate semesters or grouping course offerings; but the student enrollment factor usually has an impact on quality of instruction.

FACTORS INFLUENCING INDUSTRIAL ARTS TEACHER EDUCATION

EDUCATION	INDUSTRY
• INDUSTRIAL ARB COMMUNICATIONS CONSTRUCTION MANUFACTURING POWER	• INDUSTRY APCHITECTURAL DESIGN CONSTRUCTION ELECTRONICS GRAPHIC ARTS MECHANICAL DESIGN MECHANICAL (PRODUCTION) POWER
• TRADE AND INDUSTRIAL ARCHITECTURAL DRAFTING AUTOMOTIVE - DIESEL BUILDING CONSTRUCTION MECHANICAL DRAFTING	• INDUSTRIAL TECHNOLOGY ARCHITECTURAL DESIGN CONSTRUCTION TECHNOLOGY ELECTRONICS TECHNOLOGY MECHANICAL DESIGN MECHANICAL TECHNOLOGY POWER TECHNOLOGY
• TECHNICAL INSTITUTE ARCHITECTURAL DESIGN AUTOMOTIVE - DIESEL CONSTRUCTION TECHNOLOGY ELECTRONICS TECHNOLOGY MECHANICAL DESIGN MECHANICAL TECHNOLOGY	

PROGRAMS OFFERED BY DEPARTMENT

Figure 6

FACTORS INFLUENCING INDUSTRIAL ARTS TEACHER EDUCATION

POWER CLUSTER

REQUIRED BASIC COURSE	ELECTIVE INTERMEDIATE COURSES	ELECTIVE ADVANCED COURSES
		5 STUDENTS
	15 STUDENTS	5 STUDENTS
		5 STUDENTS
		5 STUDENTS
45 STUDENTS	15 STUDENTS	5 STUDENTS
		5 STUDENTS
		5 STUDENTS
	15 STUDENTS	5 STUDENTS
		5 STUDENTS

NUMBER OF STUDENTS MAJORING IN DEPARTMENT

Figure 7

The number of faculty in a department assigned to teach technical courses also has an impact on the quality of instruction and depth of technical content covered. In a one-man department an individual will have an extremely difficult time in "keeping up to date" in the broad cluster areas of a conceptually based program. Figure 8 shows the approximate number of full time staff at the University of Northern Iowa devoted to technical courses in each of the three cluster areas of power, communications and production.

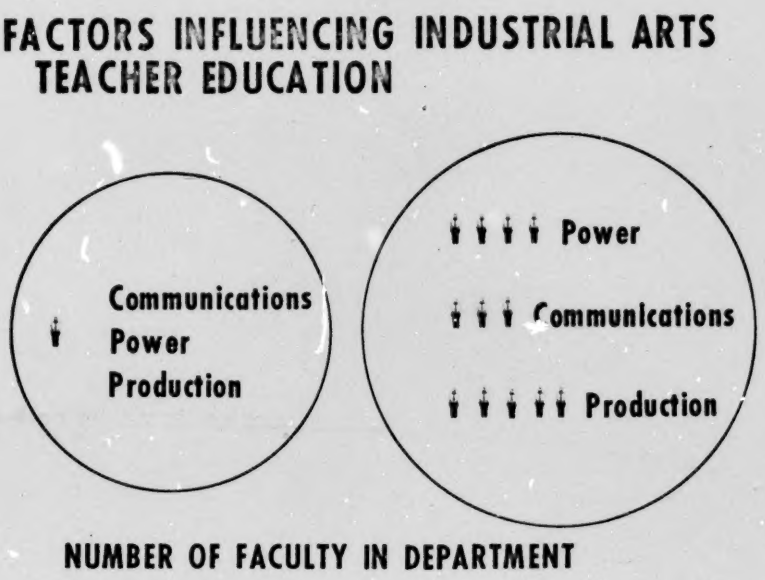
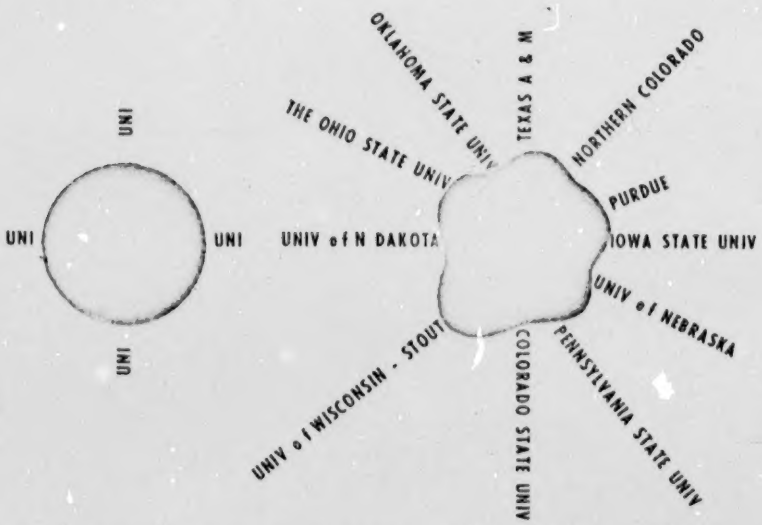


Figure 8

The faculty of a department are a strong influence on curriculum, methodology, and facility design. The amount of influence is determined by the background and interests of faculty members as well as their peer relationship to other members of the group. Figure 9 shows the various institutions where University of Northern Iowa Industrial Technology faculty members received their doctor's degree or else spent several years teaching at the college level. Although an "inbred" faculty will undoubtedly result in less variation in professional philosophy it will also probably result in limited implementation of new and innovative ideas.

Courses which teach about industry and technology are now being recognized in many institutions as valuable additions to the general education program. Each of the three basic core theory courses in the areas of power systems, communication systems and production systems are designed for students electing them as general education options as well as for requirements for majors in the Industrial Technology Department. (See Figure 10).

FACTORS INFLUENCING INDUSTRIAL ARTS TEACHER EDUCATION

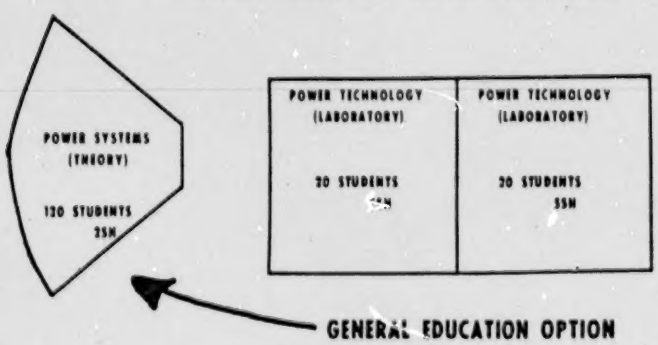


BACKGROUND, INTERESTS AND INFLUENCE OF FACULTY

Figure 9

FACTORS INFLUENCING INDUSTRIAL ARTS TEACHER EDUCATION

POWER CLUSTER CORE PROGRAM



RELATIONSHIP OF MAJOR COURSE REQUIREMENTS TO SERVICE COURSES

Figure 10

Another factor which has major program implications for industrial arts teacher education programs is the recommended program of studies outlined in the state guide for industrial arts. This is particularly true if the state guide has been up-dated to reflect new curriculum innovations in the field. Figures 11, 12 and 13 show the content structure recommended by the new Iowa State Guide for Industrial Arts at the elementary, middle and upper levels. The development of the Iowa Guide was a cooperative effort by industrial arts teachers from throughout the entire state.

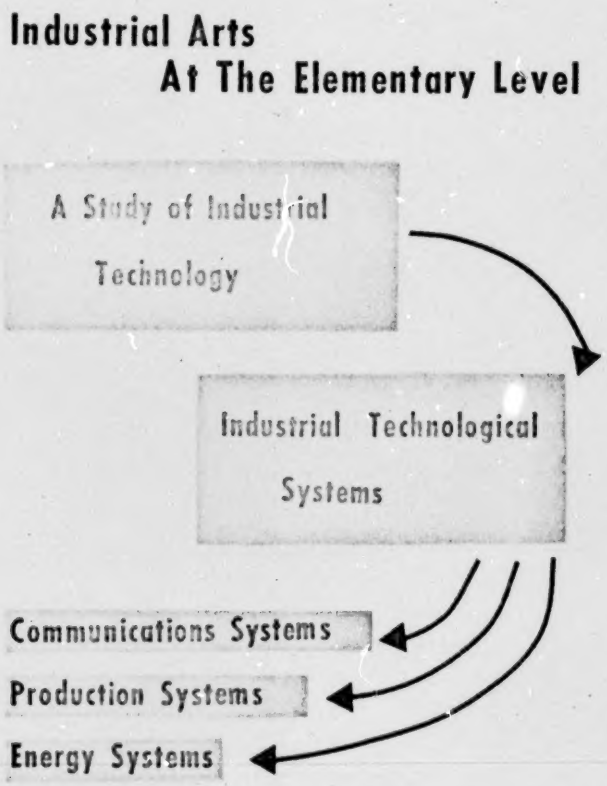
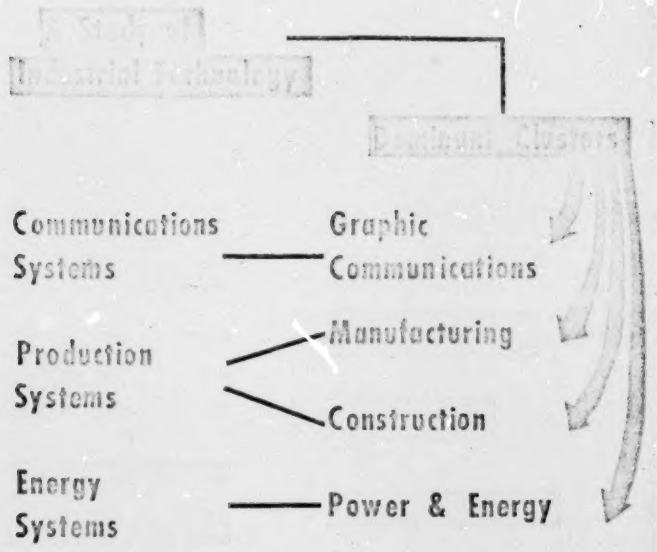


Figure 11

Industrial Arts At The Middle Level



Iowa State Guide for Industrial Arts

Figure 12

Industrial Arts At The Upper Level

a study of industrial technology

...concentrated study of selected industrial technologies

...exploration in depth

...career specialization

CLUSTER	COURSES
Graphic Communications	Design/Drafting Technology
	Graphic Arts Technology
Manufacturing	Plastics Technology
	Metals Technology
	Woods Technology
Construction	Building Construction Technology
Power & Energy	Power Technology
	Electricity/Electronics Technology

IOWA STATE GUIDE FOR INDUSTRIAL ARTS

Figure 13

Facilities available to a department also have an influence on the type of content structure selected by a department. It is difficult to offer broad conceptually based cluster courses in areas like production if a department has available only small specialized material or process oriented laboratories. (See Figure 14).

FACTORS INFLUENCING INDUSTRIAL ARTS TEACHER EDUCATION

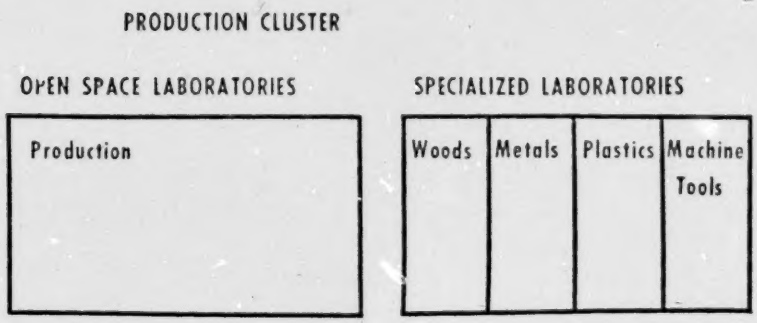
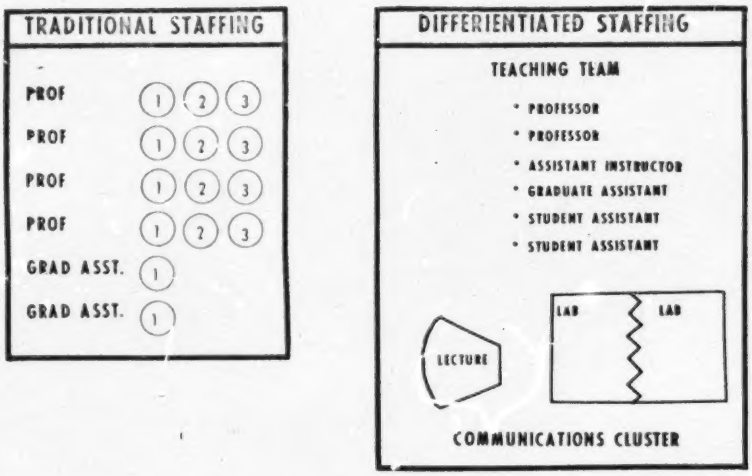


Figure 14

The staffing methods employed by a department also influence the content structure of the curriculum and the extent to which content clusters are interrelated and coordinated. Traditional staffing patterns usually give individual instructors complete control over the content emphasized in a particular course. New patterns of differentiated staffing place the responsibility for curriculum clusters on teams of full-time staff members and temporary assistants. This type of staffing encourages the continued development and implementation of comprehensive "cluster" areas. (See Figure 15).

Basic Core Theory Courses: The emphasis in the three basic theory core courses in the areas of power systems, production systems and communication systems will be on providing a basic understanding of the technology employed in these systems and on the relationship and effect these systems have on man, society and the environment. They will be taught by lecture-demonstration techniques for enrollments of up to 120 students. They will be taught by faculty teams and may be taken by students prior to, concurrently with or independently of the basic core laboratory courses.

FACTORS INFLUENCING INDUSTRIAL ARTS TEACHER EDUCATION



STAFFING METHODS

Figure 15

Basic Core Laboratory Courses: The basic core laboratory courses will follow the same conceptual content pattern as the basic core theory courses. Emphasis will be on laboratory activities which will provide a basic knowledge of technological systems and on the development of basic skills in the use of technical equipment utilized in processing information, materials or energy. Basic core theory courses must be taken prior to or concurrently with the related core laboratory courses. Instruction will be individualized, competency-based and will be taught by teaching teams.

Specific course content outlines for the basic core program being implemented in the Department of Industrial Technology at the University of Northern Iowa may be obtained by writing to the department.

A number of new innovations were incorporated into the design of the new Industrial Technology Center now being constructed on the University of Northern Iowa campus. It is important for the reader to keep in mind that the facility being discussed will serve programs in both industrial education and industrial technology with specializations available for careers in education and industry.

Current and proposed curriculum options in the department seemed to dictate that space be made available for a comprehensive conceptual approach for industrial arts majors as well as space for highly specialized technical laboratories for in-depth study in technical areas for trade and industrial education and technology majors. A review of the project budget indicated that it was simply not adequate to provide for both types of spaces.

After a thorough evaluation of the advantages and limitations of both types of spaces, a compromise solution was reached which seemed to be satisfactory to proponents of both open space and specialized area laboratories. The solution

was to provide large open space laboratories in each of the broad conceptual areas of production systems, energy systems and communication systems and to provide power operated movable walls which could be used to divide these large open spaces into specialized technical areas. Figure 16 shows the general spacial relationships of the final design adopted by the planning committee.

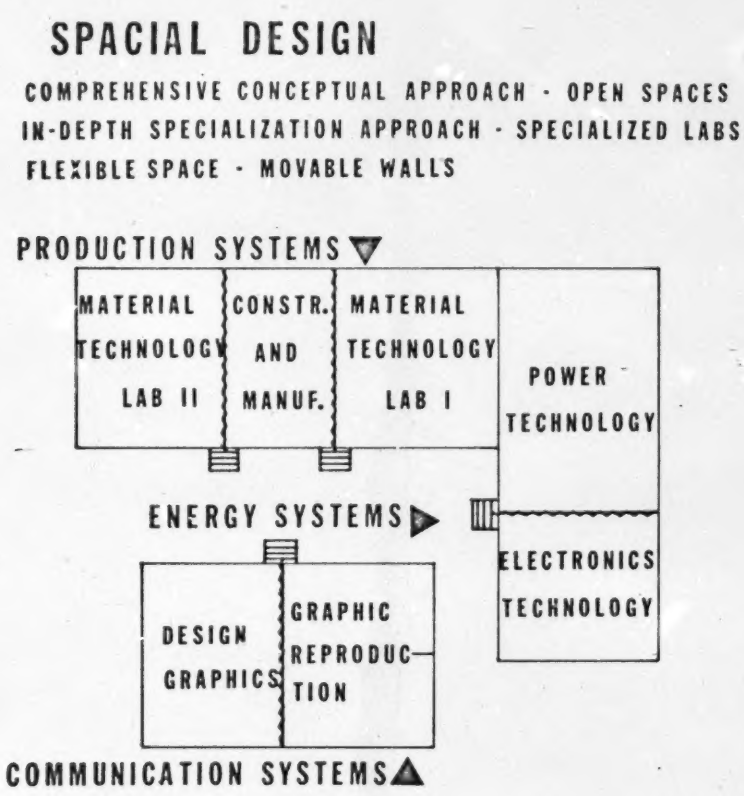


Figure 16

Figures 17, 18, and 19 show some of the programming options available with the movable walls in the open space production systems laboratory. Figure 17 shows both walls moved into position which allows for three separate and distinct in-depth technical courses to be offered at the same time by three different instructors. Figure 18 shows both walls in a retracted position allowing a broad conceptual core course to be offered in product design and manufacturing with plastics, woods and metals processing equipment moved into the central area for actual line production of products. Figure 19 shows one of the walls in a retracted position for a broad construction course to be taught in two areas plus the outdoor work area.

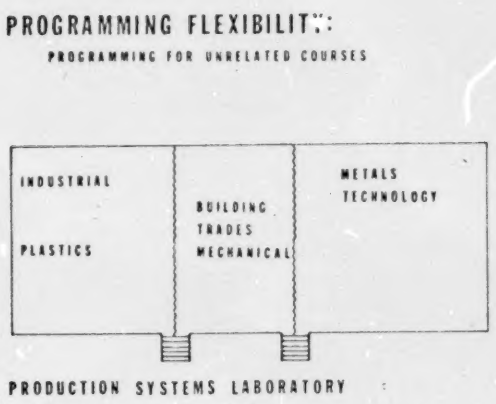


Figure 17

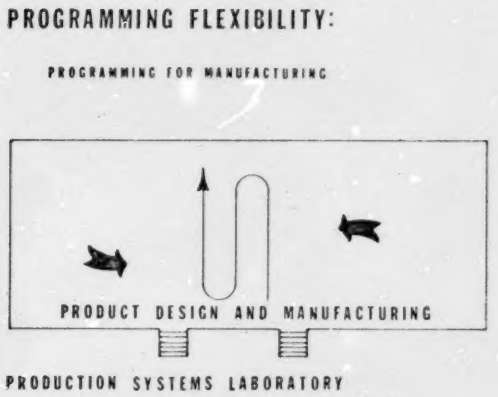


Figure 18

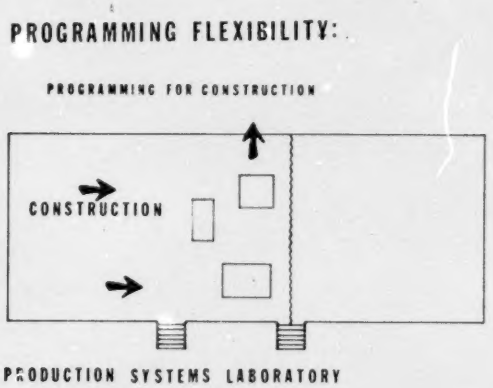


Figure 19

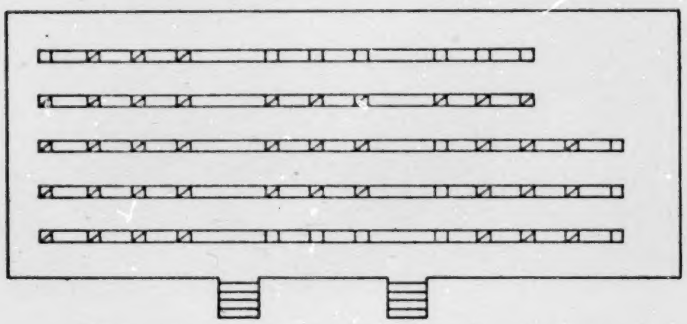
Obviously this type of programming flexibility would not be possible without a considerable degree of flexibility in locating equipment within the open space laboratory. This type of flexibility is provided by a unique utility grid system which provides for almost unlimited movement of equipment throughout the entire production systems laboratory. Figure 20 shows the trench systems which will provide for electrical power, air and exhaust utilities located on a 10' x 10' grid pattern. In actual practice these utilities can be made available in any pattern along the horizontal trenches.

Utility connections between the trench and equipment will be possible through a utility post design which seems to have the potential for revolutionizing laboratory design in industrial education. The post may be placed in position on the trench in about five minutes by simply removing a cover plate held on by four screws, "plugging in" the power, exhaust and air outlets, tipping the post up into position and fastening it in place with the same four screws used for the cover plate. See Figure 21 for details of the utility post design.

UTILITY GRID SYSTEM

ELECTRICAL POWER AND AIR OUTLETS □

EXHAUST SYSTEM ▨



PRODUCTION SYSTEMS LABORATORY

Figure 20

UTILITY POST DESIGN

ELECTRICAL POWER
EXHAUST SYSTEM
AIR OUTLETS

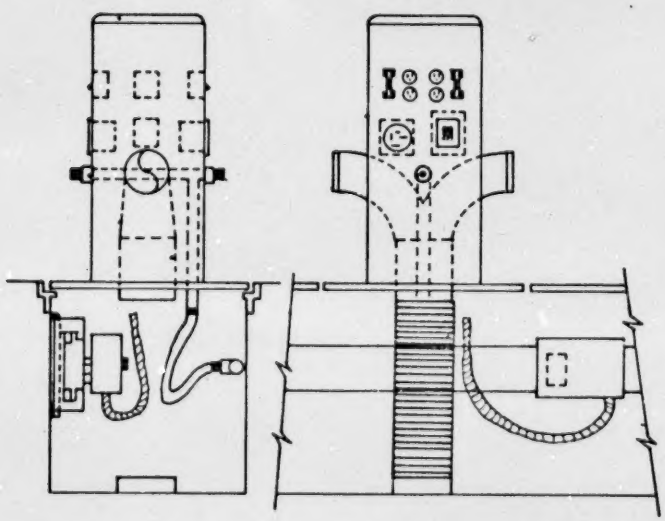


Figure 21

This same type of flexibility is available in certain areas of the communications and energy systems laboratories. Covered outlets in these areas are provided flush with the floor surface for electrical power connections on two foot centers along horizontal grids.

The majority of departmental faculty favored designing the new facility for competency based individualized instruction but there was considerable hesitancy on the part of some faculty to make a total commitment to this approach at the complete exclusion of more traditional methods. A complete analysis of new instructional approaches and faculty preferences seemed to indicate that although the department would continue to move toward individualized competency based instruction, that some courses and competencies would always be taught by large group lectures or small group interaction sessions.

The planning committee attempted to design the facility so that large group, small group, individualized instruction or a combination of these methods of instruction could be used for any course options or competency based activities. An example of this flexibility is illustrated in Figure 22, which shows the components of the closed circuit television system for the various types of instruction. All of the open space laboratories or sub-labs have individualized study carrels equipped with television monicors in addition to wall or ceiling monitors for use when teaching to small groups. A lecture bowl for up to 120 students, a classroom for 40 students and two seminar rocms for 20 students are equipped with TV monitors for large group instruction via the closed circuit television system.

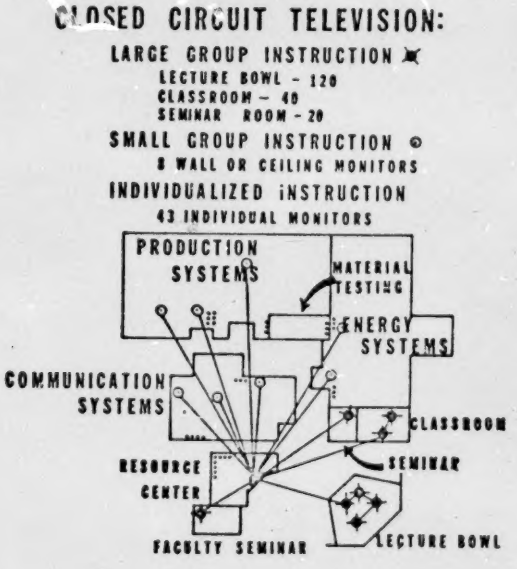


Figure 22

CCTV programming will originate in the resource center which is equipped with twelve video color cassette record and playback units. Communication within the system is made possible with a two-way intercom system with terminals located in each laboratory near the study carrels and at the resource center.

Large group instruction will be enhanced with the well-equipped lecture bowl. Figure 23 shows the general arrangement of the rear screen projection system incorporated in the lecture bowl design. The lectern is the "control center" and provides for: complete control of lecture bowl lighting including dimming capabilities; remote control of 35mm slide, filmstrip and 16mm film projectors located in the rear projection room; control of an audio tape recorder and a record player located in the lectern base; control of four CCTV monitors in lecture bowl and a remote intercom station with communication capability to resource center; and an amplified telephone system located in the base of the lectern. An overhead projector will be permanently located on the lectern.

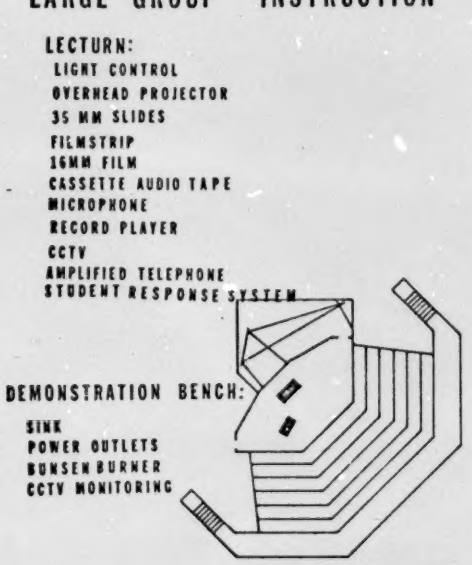


Figure 23

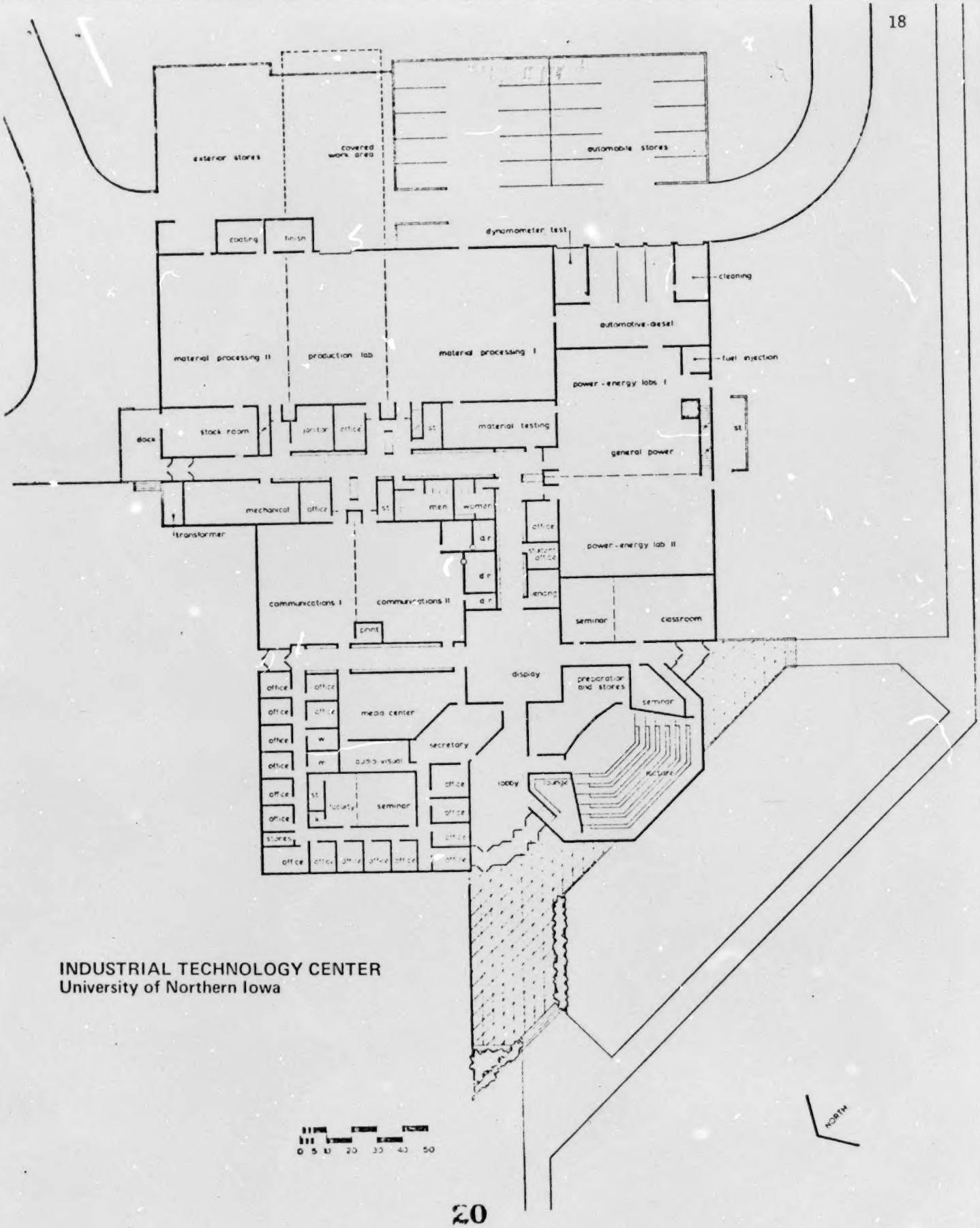
Also located in the lectern will be a control panel for a student response system with response units located at each of the 120 seats in the lecture bowl. This system will provide the instructor with immediate feedback on questions posed to the class including individual monitoring of student responses and the percentage of responses received for each response option.

The lecture bowl also contains a demonstration bench with a sink, power outlets and Bunsen burner for demonstrations. A portable TV camera will be used to provide "close-in" monitoring of demonstrations via the four ceiling mounted TV monitors. Ample space and power is available for moving in large power equipment for demonstrations.

Differentiated staffing techniques will be utilized in the new facility to provide for continuous supervision and evaluation of student progress in the open space laboratories. Each teaching team will consist of faculty members, full-time instructional assistants who will provide for continuous laboratory supervision, graduate assistants and undergraduate student assistants. A large office is provided in each cluster laboratory for all members of the differentiated staffing team except for faculty. Faculty offices are located in a separate administrative area.

Other innovations in the facility include: centralized stock room, materials testing laboratory, office for officers of student clubs, display center, graduate student lounge, and a resource center which will be the central depository for all the competency based individualized instruction modules.

The general layout of the Industrial Technology Center is shown in Figure 24. Further information about any phase of the design procedure or more details about any of the innovations may be obtained by writing to the Department of Industrial Technology at the University of Northern Iowa.



INDUSTRIAL TECHNOLOGY CENTER
University of Northern Iowa

Figure 24